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ABSTRACT

As educators increasingly integrate Web-based resources into their curriculum, there is a growing need for high quality, educationally relevant materials. This study evaluated the Bayou Bend Web site, the result of a collaboration between staff at the Museum of Fine Arts, Houston, Texas, and faculty and graduate students at the University of Houston to design and develop an educational Web site. A sample of 266 potential users reviewed the Bayou Bend Web site and submitted an online survey developed to measure user perceptions of the design, content, and educational value of the site based on criteria identified in a review of the literature. The results of the survey reveal some of the strengths and weaknesses of the Bayou Bend site (http://www.bayoubend.uh.edu) as well as provide insight into the process of evaluating educational Web sites. (Contains 18 tables and 60 references.) (SLD)

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Evaluation of an Educational Website for the Bayou Bend Collection and Gardens, Museum of Fine Arts, Houston

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Abstract

As educators increasingly integrate web-based resources into their curriculum, there is a growing need for high quality, educationally relevant materials. This study evaluated the Bayou Bend website, the result of a collaboration between staff at the Museum of Fine Arts, Houston, and faculty and graduate students at the University of Houston to design and develop an educational website. Expert designers and usability experts emphasize the importance of the users in determining if a website meets the needs and expectations of the intended audience. A sample of 266 potential users reviewed the Bayou Bend website and submitted an online survey designed to measure user perceptions of the design, content, and educational value of the site based on criteria identified in a review of the literature. The results of the survey revealed some of the strengths and weaknesses of the Bayou Bend site (http://www.bayoubend.uh.edu) as well as provided insight into the process of evaluating educational websites.

Evaluation of an Educational Website for the

Bayou Bend Collection and Gardens, Museum of Fine Arts, Houston

Evaluation, an important phase in the design and development process, is particularly critical in the development of websites designed for instructional purposes. The purpose of this evaluation was to identify the strengths and weaknesses of the Bayou Bend website in order to make improvements and to guide future development efforts by using the design and evaluation criteria identified in a review of the literature. While developers may make every attempt to adhere to specific criteria during development, ultimately the users will determine how successful developers were in their efforts to satisfy these criteria. Accordingly, this study addressed the following research questions:

1. What are users' perceptions of the design, content, and educational value of the Bayou Bend website?
2. Are there statistically significant differences in user perceptions by user group, user experience, user comfort level, or likelihood of a revisit?

The Bayou Bend Initiative

In the fall of 1997, faculty from the University of Houston (UH) met with representatives of the Museum of Fine Arts, Houston, (MFAH) to discuss how the museum could use a small grant to develop technology-based materials that would enhance public access to the arts. Since Instructional Technology faculty members at the university were searching for authentic and meaningful projects that graduate students could work on as part of their course of study, it was decided that the museum would provide the content that students would use as the basis of a web design course. In the course, CUIN 7330 - Project-Based Web Design and Development, students work in small collaborative teams to design and develop online educational resources

using raw materials provided by the museum. Students in the course work with museum education staff members to design innovative approaches to presenting the museum's educational content over the World Wide Web.

The first museum/university collaborative project in which UH students used content from the museum was the development of a website for Bayou Bend, the American decorative arts wing of the MFAH. (The URL for the Bayou Bend website is: http://www.bayoubend.uh.edu.) Bayou Bend is a house museum in Houston that contains one of the nation's finest collections of colonial era American decorative arts. Bayou Bend, like many museums and galleries, was interested in having a web presence. In addition to informing visitors of hours and location, a website affords museums an opportunity to share materials with those unable to come to the museum (Fulford, 1996; Taylor & Ryan, 1995; Wong, 2000; Zorich, 1997). Museums are using the Web not only to make their presence known but also to extend their educational missions beyond their physical walls (Blumenstyk, 1998; Bowen, 2000; Devine & Welland, 2000; Fawkner, 1997; Londoño, 2000; Solomon, 1999).

During the Bayou Bend project, students worked with museum content experts to develop site navigation, page design, and educational resources to showcase Bayou Bend and its collection. In order to create the website, participants in the course were given access to brochures on Bayou Bend's collection, founder, and gardens, and the recently published catalogue *American Decorative Arts and Paintings in the Bayou Bend Collection*. These resources provided important information and images that student developers used as the foundation of the site. In addition, student teams created searchable databases, produced virtual room tours, and integrated streaming media content into the site. A paper entitled *A Museum-*

University Partnership to Develop Web-Based Educational Resources (Robin, Jenkins, Howze, & O'Connor, 2001) describes the Bayou Bend web development project in more detail.

Website Design, Development, and Evaluation

Although the creation of websites is somewhat limited by the web publishing medium itself, the literature suggests that established principles of information and graphic design can help to guide the design and development process. Widely accepted publication standards and style guides are available to guide the development of content (Lynch & Horton, 1999). Numerous books and articles offer suggestions on how to create a website, how to create web graphics, and how best to present web-based information (e.g., Andres, 1999; DiNucci, Giudice, & Stiles, 1997; Duff & Mohler, 1996; Holzschlag, 1998). In addition, many books and articles suggest criteria for evaluating the quality of websites (e.g., Alexander & Tate, 1999; Cooke, 1999; Pratt, Flannery, & Perkins, 1996). Much of the literature emphasizes the importance of the users in the design as well as the evaluation phase. Experts recommend that the design process begin by addressing the purpose of the site and the target audience (Lynch & Horton, 1999; Rosenfeld & Morville, 1998). Usability experts stress the important role users play in determining if a site fulfills its purpose and meets the needs and expectations of the intended audience (Head, 1999; Krug, 2000; Mayhew, 1999; Nielsen, 2000; Spool, 1999).

Art, Social Studies, History, and Museum Education and the Web

There is a growing interest in using web-based educational resources in both K-12 and higher education. Indeed, the federal government appears to have embraced "the power of the Internet for learning" (see Web-based Education Commission, 2000), and state and national standards require the integration of technology into the curriculum. Chapter 113, Texas Essential Knowledge and Skills for Social Studies (K.15), for example, requires that students be able to

apply "critical-thinking skills to organize and use information acquired from a variety of sources including electronic technology" (TEA, 2001). The National Standards for Social Studies Teachers states that "social studies teaching and learning are powerful when they are integrative" and that integration is encouraged when "the teaching makes effective use of technology" (NCSS, 2001). Numerous published guides are available to introduce teachers to countless art, social studies, and history-related websites (e.g., Braun & Risinger, 1999; Cohen, 1998; Crane, 2000; Diaz, 1997; Fredericks, 2000; Leu & Leu, 1999; Partin, 1998; Trinkle & Merriman, 2000; Willis, 1997). Many guides and articles provide suggestions on how to incorporate these resources into the curriculum and use technology to achieve curricular goals (e.g., Boyer, 1999; Braun, 1999; Cassutto, 2000; Singleton & Giese, 1999; VanFossen & Shiveley, 2000; Zukas, 2000). These guides and articles frequently recommend museum websites for use in the classroom.

Although some educators believe that using the Web can enhance the learning environment (e.g., Bridges & DeVaull, 1999; Diem, 2000), others argue that the evidence on how the Web can promote learning has not been forthcoming (e.g., Garrett, 1997; Owston, 1997; Windschitl, 1998). Windschitl emphasizes the need for empirical rather than anecdotal evidence concerning the results of Internet-based teaching and learning, and recommends areas for further research (e.g., the influence of the Web on independent student inquiry and the role of teachers). Berson (1996) and Diem (2000) note that few studies substantiate the positive effects of technology in social studies classrooms as an instructional component. Optimistic that the evidence will be forthcoming at a future date, Mioduser, Nachmias, Lahav, and Oren (2000) nonetheless acknowledge their research indicates that many educational websites currently are lacking in pedagogical approaches. Maddux (1996) concludes that, in spite of the immense

potential of the Web as a learning tool, the educational value is limited because web authors, even educators, seem to ignore the principles of learning. The lack of educational resources as well as the quality of information and educational resources available over the Internet also concerns educators. Information is not peer referenced or reviewed (Gray, 1999). There are no editorial standards nor is anyone in charge of the Internet. The ease with which web authors can create and publish pages has resulted in a large number of web resources of questionable quality (Barlow, 1998; Cashen, 1995; Cooke, 1999; Doyle & Martorana, 1999; Johnson, 1998).

Methods

Participants

The participants came from several different populations of potential Bayou Bend website users, including Bayou Bend docents, K-12 teachers, faculty, graduate students, library professionals, and others interested in web-based educational resources.

Instrument

This study used a 53-item web-based survey instrument developed specifically to measure user perceptions of the design, content, and educational value of the Bayou Bend website (see Appendix). The first portion of the survey consisted of a Likert-type rating scale (1 = strongly disagree to 4 = strongly agree) for the evaluation criteria previously identified in the literature. The survey also included items to measure user perceptions of the educational value of components such as the lesson plans and bibliography. The second part of the survey asked participants to compare the education section, usability, information, and use of multimedia on this site to other art museum websites using a five-point scale (1 = much worse to 5 = much better). The third part of the survey requested demographic information including status, subject expertise, how often participants use the Internet, how comfortable they are using

the Internet, how much time they spent reviewing the site before evaluating it, and how likely they are to visit the site again. The fourth and final part of the survey provided an opportunity for participants to write in comments and suggestions for improvement. A principal components factor analysis, conducted to establish the construct validity of Items 1 to 32, revealed five factors with eigenvalues greater than 1.0, which represented 57% of the total variance. Table 1 shows the rotated factor loadings of the 30 items on the survey used to construct the five scales named (a) content, (b) educational value, (c) information architecture, (d) graphic design/page layout, and (e) search system. Loadings less than the .50 criterion level previously set resulted in the elimination of Item 3 (contact information is available) and Item 4 (the purpose of the site is apparent) from the scales. Factor loadings for the remaining 30 items ranged from .50 to .79. Cronbach's coefficient alpha established internal consistency reliability for each of the factors.

Table 1 Factor Loadings of 30 Items on the Bayou Bend Evaluation Survey

Variables	Factors 1	2	3	4	5
CONTENT					
1 The organization responsible for the site is an expert on the subject	68				
2 The information appears to be up-to-date	65				
5 The information adequately covers the subject matter	57				
6 The information adheres to high editorial standards	58				
7 The information appears to be factual	74				
EDUCATIONAL VALUE					
8 Copyright information is available		52			
25 The lesson plans are suitable for teaching the subject matter		70			
26 The activities for children reinforce the educational experience of an actual visit to Bayou Bend		68			
27 The Belter Parlor "case study" provides insight into the work of a curator		65			
28 The bibliography is helpful for learning more about the subject		72			
29 The links to other websites in the "Education" section support the subject matter		79			
30 The site supports independent learning		74			
31 The depth of the information is adequate for educational purposes		74			
32 I would use this site as an educational resource		68			
INFORMATION ARCHITECTURE					
9 The information is well organized			60		
10 It is easy to find information about the collection			52		
11 It is clear where each link will take you			69		
12 It is clear which section of the site you are in at all times			70		
13 The navigation system for browsing the site is consistent			53		
GRAPHIC DESIGN/PAGE LAYOUT					
17 All of the pages have a similar look				55	
18 The graphic design supports rather than competes with the display of information				70	
19 The page layout makes the site easy to use				60	
20 The color scheme is appropriate for the subject matter				66	
21 The same basic elements appear in the same location on all pages				58	
22 The typefaces used are appropriate for the subject matter				76	
23 The information is clearly presented on each page				64	
24 There is a good balance between text and images				50	
SEARCH SYSTEM					
14 The "Collection Search" makes it clear that only the collection is being searched					50
15 The "Search Help" provides clear examples of how the search system works					69
16 I found what I was looking for using the search system					70
Eigenvalues	10.15	3.71	1.72	1.45	1.22
% of Variance	11.20	15.71	9.52	13.35	7.25

Procedures

Data collection occurred over an eight-week period from February to April 2001. Volunteer participants received invitation letters via the mail, in person, and through email, (i.e., online discussion groups for art, social studies, history, educational technology, and librarianship) to review the site and submit the online survey. At the end of eight weeks, there were 286 responses to the survey. The researcher eliminated 20 responses as follows: 3 blanks, 9 exact duplicates, 3 questionable responses (e.g., all items rated very low, but rated "much better" in the comparison section), and 5 outliers in a one-way ANOVA of each factor.

Analysis

Basic descriptive statistics describe the characteristics of the participants as well as the survey results. The final data analysis used a three-way ANOVA on each of the five factors. The three independent variables were (a) user group, (b) user comfort level, and (c) likelihood of a revisit. The five dependent variables were the factors identified through factor analysis: (a) content, (b) educational value, (c) information architecture, (d) graphic design/page layout, and (e) search system. Pearson Product-Moment Correlations were used to determine the nature of the relationships among the items used to evaluate the multimedia components. A review of the comments and suggestions for improvement written in by the participants helped to identify areas for improvement.

Results

The results of this study indicate that the participants had favorable perceptions of the design and content but less than favorable perceptions of the educational value. The results also indicate that there are statistically significant differences by user group, user comfort level, and likelihood of a revisit. There are no statistically significant differences by user experience.

Demographic Characteristics

As shown in Table 2, the final sample of 266 participants consisted of Bayou Bend docents (n = 26), library professionals (n = 51), faculty (n = 30), graduate students (n = 93), K-12 teachers (n = 30), and others interested in web-based educational resources (n = 36). Because participants were able to select more than one status, for the purpose of this study user groups were determined as follows. Bayou Bend docents took precedence over all other groups. After the Bayou Bend docents, library professionals (including library directors, library faculty, librarians, and archivists) took precedence over the remaining groups. Next, were faculty, graduate students, and K-12 teachers, respectively. The "other" group (n = 36) consisted of undergraduates (n = 11), museum professionals including museum directors, curators, and museum educators (n = 9), technical writers (n = 4), usability experts (n = 4), webmaster (n = 1), board assistant (n = 1), horticulturist (n = 1), and online discussion participant (n = 1). Five participants did not indicate their status.

Table 2 **User Group as Determined by Status**

Group	Frequency	Percentage of Total (%)
Bayou Bend Docents	26	10
Library Professionals	51	19
Faculty	30	11
Graduate Students	93	35
K-12 Teachers	30	11
Others	36	14
	266	100

A majority of the participants reported subject expertise in one of the three subject areas: art, social studies, and history. An exact percentage is not available as many of the participants reported an expertise in more than one area, but 48% reported subject expertise that was other than art, social studies, or history (Table 3). An overwhelming majority (84%) of the participants reported using the Internet "daily" (Table 4). Most of the participants said they were "very comfortable" (55%) using the Internet (Table 5). Almost half (48%) of the participants said they spent more than 30 minutes reviewing the site in order to evaluate it (Table 6). Most of the participants also reported that they would be "very likely" (24%) or "likely" (49%) to revisit the website (Table 7).

Table 3 **Area of Subject Expertise**

Subject Area	Frequency	Percentage (%)
Art Education	36	14
Decorative Arts	36	14
Fine Arts	55	21
Social Studies	34	13
U.S. History	60	23
Other	127	48

Note. Totals do not equal 100 as some participants indicated expertise in more than one subject area.

Table 4 **How Often Respondents Use the Internet**

Internet Usage	Frequency	Percentage of Total (%)
Daily	223	84
Weekly	33	12
Monthly	1	0
Almost never	4	2
No response	5	2
Total	266	100

Table 5 **How Comfortable Respondents Are Using the Internet**

Comfort Level	Frequency	Percentage of Total (%)
Very comfortable	145	55
Comfortable	62	23
Not comfortable	2	1
Very uncomfortable	52	20
No response	5	2
Total	266	101

Note. Rounded off percentages do not equal 100.

Table 6 **How Much Time Respondents Spent Reviewing the Website**

Amount of Time	Frequency	Percentage of Total (%)
More than an hour	26	10
30 minutes to an hour	101	38
15 to 30 minutes	107	40
Less than 15 minutes	27	10
No response	5	2
Total	266	100

Table 7 **How Likely Respondents Are to Visit the Website Again**

Likely to Revisit Website	Frequency	Percentage of Total (%)
Very likely	65	24
Likely	131	49
Not likely	52	20
Very unlikely	13	5
No response	5	2
Total	266	100

Results for Multimedia Components

As shown in Table 8, less than half of the participants reported being able to access the audio clips (40%) or video clips (44%), while a majority reported being able to access the virtual room tour (55%).

Table 8 **Ability to Access Multimedia Components**

Component	Frequency	Percentage of Total (%)
Able to access audio clips		
Yes	106	40
No	149	56
No response	11	4
Total	266	100
Able to access video clips		
Yes	116	44
No	135	51
No response	15	6
Total	266	101
Able to access virtual room tour		
Yes	147	55
No	106	40
No response	13	5
Total	266	100

Note. Rounded off percentages do not equal 100.

Tables 9 and 10 show the results of the Pearson Product-Moment Correlations for the audio clip and video clip variables, respectively. There is a statistically significant positive very high correlation between Add Interest and Enhance the Content for both the audio clip variables and the video clip variables ($r = .97$, $p < .001$). The standard deviations, which are larger than the means, suggest a serious dispersion problem (i.e., there are large differences in the ways participants responded to those items).

Table 9 **Results Obtained from Pearson Product-Moment Correlation for Audio**

	Add Interest		Enhance the Content			
N	M	SD	M	SD	r	p
266	1.43	1.75	1.38	1.75	.97	< .001

Note. A score of 4 indicates that participants responded "Strongly Agree" to Item 34 "The audio clips add interest to the site" and Item 35 "The audio clips enhance the content of the site." A score of 1 indicates that participants responded "Strongly Disagree."

Table 10 **Results Obtained from Pearson Product-Moment Correlation for Video**

	Add Interest		Enhance the Content			
N	M	SD	M	SD	r	p
266	1.53	1.76	1.53	1.77	.97	< .001

Note. A score of 4 indicates that participants responded "Strongly Agree" to Item 37 "The video clips add interest to the site" and Item 38 "The video clips enhance the content of the site." A score of 1 indicates that participants responded "Strongly Disagree."

As shown in Table 11, there is a statistically significant positive very high correlation between Adds Interest and Visit Preparation (r = .94, p < .001), between Adds Interest and Visitor Attraction (r = .94, p < .001), and between Visit Preparation and Visitor Attraction (r = .95, p < .001). The standard deviations, which are almost as high as the means, suggest that there are large differences in how participants responded to those items.

Table 11 Means, Standard Deviations, and Correlations for Virtual Room Tour Variables

	M	SD	A	B	C
A. Adds Interest	2.06	1.84	1.00		
B. Visit Preparation	1.94	1.82	.94***	1.00	
C. Visitor Attraction	1.91	1.79	.94***	.95***	1.00

Note. A score of 4 indicates that participants responded "Strongly Agree" to Item 40 "The virtual room tour adds interest to the site," Item 41 "The virtual room tour is a good preparation for an actual visit," and Item 42 "The virtual room tour will attract visitors to the 'real' Bayou Bend." A score of 1 indicates that participants responded "Strongly Disagree" to the items.
***p < .001.

The frequencies shown in Table 12 indicate that many participants did not respond to the items regarding the audio clips, video clips, or the virtual room tour. The results suggest that most of the participants who were able to access the multimedia components had favorable perceptions of the audio and video clips as well as the virtual room tour.

Table 12 Frequencies of Multimedia Items on the Bayou Bend Evaluation Survey

Variables	Frequencies				
	0	1	2	3	4
AUDIO CLIPS					
34. The audio clips add interest to the site.	155	3	3	49	56
35. The audio clips enhance the content of the site.	159	2	8	38	59
VIDEO CLIPS					
37. The video clips add interest to the site.	146	2	8	50	60
38. The video clips enhance the content of the site.	147	3	8	45	63
VIRTUAL ROOM TOUR					
40. The virtual room tour adds interest to the site.	113	2	6	45	100
41. The virtual room tour is a good preparation for an actual visit.	119	3	9	46	89
42. The virtual room tour will attract visitors to the "real" Bayou Bend.	118	4	11	51	82

Note. 0 = No Response, 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree.

Results for Comparisons to Other Art Museum Websites

As shown in Table 13, less than half of the participants (48%) thought that the Education Section was "better" or "much better" than art other museum websites. The majority of participants (56%), however, thought the Usability of the site was better or much better. Most participants (54%) also thought the Information was better or much better. Less than half of the participants (49%) thought the Use of Multimedia was better or much better. Over 10% of the participants did not respond to any of the comparisons to other art museum websites.

Table 13 **Frequencies for Comparisons to Other Art Museum Websites**

	Frequency	Percentage of Total (%)
Education Section		
Much better	32	12
Better	96	36
About the same	95	36
Worse	4	2
Much worse	0	0
No response	39	15
Total	266	101
Usability		
Much better	36	14
Better	112	42
About the same	82	31
Worse	4	2
Much worse	0	0
No response	32	12
Total	266	101
Information		
Much better	40	15
Better	103	39
About the same	88	33
Worse	1	0
Much worse	1	0
No response	33	12
Total	266	99
Use of Multimedia		
Much better	42	16
Better	87	33
About the same	81	30
Worse	5	2
Much worse	3	1
No response	48	18
Total	266	100

Note. Rounded off percentages do not equal 100.

Descriptive Results

As shown in Table 14, on a scale from 1 to 4 (1 = strongly disagree to 4 = strongly agree), the mean score for the site overall was 3.23. Content received the highest rating (M = 3.50), followed by Graphic Design/Page Layout (M = 3.47), Information Architecture (M = 3.39), and Educational Value (M = 2.91). Search System received the lowest rating (M = 2.89). The standard deviations for Educational Value and Search System suggest that there was more variation on these scales. Frequencies for each item included in the factors as shown in Table 15 indicate that more participants did not respond to items for Educational Value and Search System.

Table 14 **Means and Standard Deviations for the Five Factors**

Factor	M	SD
Content	3.50	0.48
Educational Value	2.91	0.94
Information Architecture	3.39	0.57
Graphic Design/Page Layout	3.47	0.50
Search System	2.89	0.97
Overall Rating	3.23	0.51

Table 15 **Frequencies of 30 Items on the Bayou Bend Evaluation Survey**

Variables	Frequencies				
	0	1	2	3	4
CONTENT					
1. The organization responsible for the site is an expert on the subject.	0	2	7	97	160
2. The information appears to be up-to-date.	0	3	18	92	153
5. The information adequately covers the subject matter.	0	1	10	118	137
6. The information adheres to high editorial standards.	5	1	11	109	140
7. The information appears to be factual.	2	2	4	97	161
EDUCATIONAL VALUE					
8. Copyright information is available.	28	2	19	101	116
25. The lesson plans are suitable for teaching the subject matter.	45	0	21	119	81
28. The activities for children reinforce the educational experience of an actual visit to Bayou Bend.	41	3	15	111	96
29. The Belter Parlor "case study" provides insight into the work of a curator.	61	4	15	112	74
28. The bibliography is helpful for learning more about the subject.	36	1	13	105	111
29. The links to other websites in the "Education" section support the subject matter.	44	2	4	107	109
30. The site supports independent learning.	19	3	11	125	108
31. The depth of the information is adequate for educational purposes.	19	2	13	129	103
32. I would use this site as an educational resource.	23	5	21	108	109
INFORMATION ARCHITECTURE					
9. The information is well organized.	2	1	14	96	153
14. It is easy to find information about the collection.	2	5	16	100	143
15. It is clear where each link will take you.	2	2	24	117	121
16. It is clear which section of the site you are in at all times.	2	3	21	117	123
17. The navigation system for browsing the site is consistent.	5	5	13	108	135
GRAPHIC DESIGN/PAGE LAYOUT					
17. All of the pages have a similar look.	4	3	16	91	152
18. The graphic design supports rather than competes with the display of information.	2	5	6	86	167
19. The page layout makes the site easy to use.	0	2	12	102	150
20. The color scheme is appropriate for the subject matter.	1	3	7	102	153
21. The same basic elements appear in the same location on all pages.	5	0	7	100	154
22. The typefaces used are appropriate for the subject matter.	3	4	7	112	140
23. The information is clearly presented on each page.	0	3	4	100	159
24. There is a good balance between text and images.	2	7	29	102	126
SEARCH SYSTEM					
14. The "Collection Search" makes it clear that only the collection is being searched.	16	2	17	126	105
15. The "Search Help" provides clear examples of how the search system works.	40	4	17	121	84
16. I found what I was looking for using the search system.	30	12	33	105	86

Note. **0 = No Response, 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree.**

Three-Way ANOVA Results

A three-way ANOVA by user group, user comfort level, and likelihood of a revisit for each factor revealed statistically significant differences by user group for Educational Value ($p < .001$) and Content and Graphic Design/Page Layout ($p < .01$), by user comfort level for Graphic/Design Page Layout ($p < .001$), and by likelihood of a revisit for Educational Value ($p < .001$), Content and Graphic Design/Page Layout ($p < .01$), and Information Architecture ($p < .05$).

User Group. As shown in Table 16, Library Professionals rated the Content statistically significantly higher than did Others. There is no statistically significant difference between Library Professionals and Bayou Bend Docents, Faculty, Graduate Students, and K-12 Teachers or between Others and Bayou Bend Docents, Faculty, Graduate Students, and K-12 Teachers for Content. Library Professionals, Faculty, Graduate Students, and K-12 Teachers rated the Educational Value statistically significantly higher than Bayou Bend Docents. There is no statistically significant difference between Others and Bayou Bend Docents, Library Professionals, Faculty, Graduate Students, and K-12 Teachers for Educational Value. Library Professionals rated the Graphic Design/Page Layout statistically significantly higher than did Bayou Bend Docents and Others. There is no statistically significant difference between Library Professionals, Faculty, Graduate Students, and K-12 Teachers or between Bayou Bend Docents and Faculty, Graduate Students, K-12 Teachers, and Others for Graphic Design/Page Layout. There is no statistically significant difference between Bayou Bend Docents, Library Professionals, Faculty, Graduate Students, K-12 Teachers, and Others for Information Architecture or Search System.

Table 16

Three-Way ANOVA Summary of Differences of Factors by User Group

Factors	Bayou Bend Docents (n = 26) M	SD	Library Professionals (n = 51) M	SD	Faculty (n = 30) M	SD	Graduate Students (n = 93) M	SD	K-12 Teachers (n = 30) M	SD	Others (n = 36) M	SD	F
Content	3.30ab	0.52	3.62a	0.44	3.63ab	0.41	3.54ab	0.43	3.43ab	0.47	3.31b	0.62	3.542**
Educational Value	2.13b	1.14	2.96a	0.97	3.17a	0.77	3.09a	0.69	2.92a	1.00	2.71ab	1.08	5.383***
Information Architecture	3.27	0.58	3.49	0.48	3.55	0.58	3.37	0.58	3.43	0.56	3.23	0.65	1.443
Graphic Design Page Layout	3.31b	0.60	3.67a	0.41	3.53ab	0.49	3.47ab	0.50	3.45ab	0.47	3.29b	0.54	3.344**
Search System	2.54	0.97	2.94	1.11	3.21	1.00	2.88	0.93	3.01	0.76	2.76	0.99	1.141

Note. Means with the same letter are not statistically significantly different. A score of 4 indicates that participants responded "Strongly Agree" to all of the items on the scale. A score of 1 indicates that participants responded "Strongly Disagree" to all of the items on the scale.
**p < .01 ***p < .001

User Comfort Level. As shown in Table 17, participants who are "very comfortable" using the Internet rated the Graphic Design/Page Layout statistically significantly higher than those who are "not very comfortable" using the Internet ($p < .001$). There are no statistically significant differences by user comfort level for Content, Educational Value, Information Architecture, or Search System. The standard deviations for Educational Value and Search System suggest that there was more variation on responses for those factors than the other factors.

Table 17 3-Way ANOVA Summary of Differences of Factors by User Comfort Level

Factors	Very Comfortable (n = 145) M	SD	Not Very Comfortable (n = 121) M	SD	F
Content	3.52	0.44	3.47	0.53	0.037
Educational Value	3.03	0.77	2.77	1.09	2.048
Information Architecture	3.44	0.53	3.33	0.62	0.306
Graphic Design/Page Layout	3.59	0.42	3.34	0.56	10.979***
Search System	3.00	0.96	2.76	0.97	1.748

Note. A score of 4 indicates that participants responded "Strongly Agree" to all of the items on the scale. A score of 1 indicates that participants responded "Strongly Disagree" to all of the items on the scale.
***$p < .001$.

Likelihood of a Revisit. As shown in Table 18, there is a statistically significant difference by likelihood of a revisit for Educational Value ($p < .001$), for Content and Graphic Design/Page Layout ($p < .01$), and for Information Architecture ($p < .05$). Participants who are "very likely" or "likely" to revisit the site rated Educational Value statistically significantly higher than did those "not likely" to revisit. Participants who are "very likely" to revisit the site rated Content, Graphic Design/Page Layout, and Information Architecture statistically significantly higher than did those "not likely" to revisit. The standard deviations for Educational Value and Search System again suggest that there was more variation on responses for those factors than the other factors.

Table 18 3-Way ANOVA Summary of Differences of Factors by Likelihood of a Revisit

Factors	Very Likely (n = 65) M	SD	Likely (n = 131) M	SD	Not Likely (n = 70) M	SD	F
Content	3.63a	0.40	3.50ab	0.47	3.37b	0.55	5.231**
Educational Value	3.15a	0.79	2.98a	0.91	2.56b	1.03	8.026***
Information Architecture	3.54a	0.49	3.37ab	0.53	3.29b	0.68	3.463*
Graphic Design/Page Layout	3.62a	0.44	3.47ab	0.48	3.35b	0.57	5.752**
Search System	2.98	1.06	2.94	0.93	2.72	0.96	1.277

Note. Means with the same letter are not statistically significantly different. A score of 4 indicates that participants responded "Strongly Agree" to all of the items on the scale. A score of 1 indicates that participants responded "Strongly Disagree" to all of the items on the scale.
*$p < .05$. **$p < .01$. ***$p < .001$.

Open-Ended Comments and Suggestions for Improvement

More than half of the participants (n = 158) wrote comments or suggestions for improvement to the site. Most comments addressed very specific items covered in the survey. Some of the comments were favorable (e.g., "I thought the education portions and student activities were excellent"). Many of the comments, however, noted deficiencies or problems (e.g., "The lesson plans are not much good unless they are tied to actual school curricula or at least have specific learning goals attached"). Several of the participants commented that the website made them want to visit the real Bayou Bend Collection and Gardens.

Information Architecture. Comments regarding elements of the information architecture were generally favorable. Many participants were particularly complimentary about the organization of the site (e.g., "The site is beautifully organized"). Others suggested improving the labels (e.g., "The difference between 'information' and 'about Bayou Bend' isn't very clear - I had to click on these to see what these included").

Search System. Most comments about the search system were not favorable. Participants reported that they were unable to find what they were looking for, and some commented that they found the search help to be inadequate. Not all comments were unfavorable. One participant wrote, "The search tool is outstanding for taking a closer look at particular pieces of the collection."

Content. Most comments regarding the content pertained to the currency and accuracy of the information, noting that some of the lecture information was out of date and some of the information about the rooms was inaccurate. A number of participants offered suggestions for additions to the content such as special events and more information about the rooms, Miss Hogg, and the gardens.

Graphic Design/Page Layout. Comments regarding elements of the graphic design and page layout were generally favorable (e.g., "The layout and design is fantastic"). Suggestions for improvement included the use of more color on the site as well as more and larger images.

Educational Components. Most of the education-related comments pertained to the lesson plans. Some comments were favorable (e.g., "The lesson plans are a great resource for teachers"). Other comments were not so favorable (e.g., "I, however, would not rate the lesson plans particularly high...I'm not sure what students are supposed to know at the end"). Several participants recommended more lesson plans and activities on the site as well as information and images about the costume presentation the docents do for the fifth grade tours. Comments regarding the bibliography and the research guide were generally favorable.

Multimedia Components. Most comments regarding the audio and video clips and the virtual room tour were not favorable. Participants reported technical difficulties with downloading the RealPlayer and QuickTime plug-ins. Many participants wrote about problems that they had accessing the audio and video clips as well as the virtual tour (e.g., "The virtual tour came up as only a strip of the room it meant to show"). Some participants expressed frustration while others expressed disappointment at not being able to access these components. Participants also noted that download time was a problem. Another concern was the poor quality of the video clips and the virtual tour QuickTime movies. Some comments, however, were favorable (e.g., "The virtual tour is very well done–great quality on the images, and good descriptions").

Discussion

The results of this evaluation identified several areas for improvement. They also suggest a number of implications for practice as well as for further research in the design, development, and evaluation of educational websites.

The first research question this study addressed was "What are users' perceptions of the design, content, and educational value of the Bayou Bend website?" The results of the study indicate that the participants had generally favorable perceptions of the content, information architecture, and graphic design/page layout. This suggests the participants perceived the information as good, the structure, navigation, labeling, and graphic design/page layout functional. The participants, however, had less than favorable perceptions of the search system, multimedia components, and the educational value of the Bayou Bend website. This suggests a need for developers to investigate (a) why potential users of the site had poor perceptions of these components and (b) how these components might be improved.

Search System. Although the Search System received the lowest rating of all of the factors, a review of the frequencies for the items measuring this scale reveals that a larger number of participants did not respond to these items than responded to items measuring the other factors, with the exception of Educational Value, which also received a lower rating than did the other factors. Most of the participants who responded to the search-related items rated the Search System favorably. Written comments regarding the Search System seem to indicate that participants expected there to be more items than are currently available in the database (e.g., "Why were there only 13 items when I searched 'ceramics', and only 1 item when I searched 'tea table'?"). At this writing, there are only 13 ceramic items and only 1 tea table in the database. While the Bayou Bend Collection now consists of over 5,000 objects, MFAH administrators

have chosen to include only 127 objects in the database on the website. The written comments and low rating suggest a need to reevaluate the nature of the items used to measure user perceptions of the Search System. In particular, Item 16 "I found what I was looking for using the search system" should perhaps be changed to see if users can locate a specific object (e.g., "It is easy to find the 'Boy with Toy Horse' portrait using the search system"). Items of this nature may be a better measure of the *functionality* of the search system as opposed to *content* of the site.

Multimedia Components. Participants rated the audio clips and video clips very poorly on both variables "add interest" and "enhance the content." A majority of participants, however, did not respond or responded that they were unable to access the audio and video clips. A review of the frequencies for these items reveals that most of the participants who accessed the audio and video clips rated them favorably. This suggests that the choice of audio and video clips is appropriate for the Bayou Bend website. The inability of most participants to access the audio and video clips indicates a need for developers to explore the reasons why participants were unable to access these components (e.g., the clips are difficult to locate on the site or users lack Internet expertise). Participants also rated the virtual room tour variables "adds interest," "visit preparation," and "visitor attraction" poorly. Again, a large number of participants reported that they were unable to access the virtual room tour or did not respond to the item regarding access. A review of the frequencies for the virtual tour-related items reveals that most of the participants who rated these variables rated them favorably as well. This suggests that the virtual room tour is an appropriate multimedia component for the Bayou Bend website. The inability of many participants to access the virtual room tour indicates a need for developers to investigate problems with accessibility (e.g., long download times or lack of Internet expertise).

Educational Value. Participants rated the Educational Value of the Bayou Bend website lower than they rated Content, Information Architecture, and Graphic Design/Page Layout, however, a review of the frequencies for items measuring this scale reveals that more participants did not respond to these items than for any other factor. Most of the participants who did respond rated these items favorably although a fair number of participants rated them poorly. These results suggest that perhaps many of the participants who responded to the survey were an inappropriate audience for evaluating the educational components, such as lesson plans and activities for children, either due to a lack of interest or qualifications. The results for those that did respond to the education-related items suggest a need to improve the educational components of the site. More participants did not respond to the item regarding the usefulness of the Belter Parlor "case study" than for any other item measuring a factor. Either a lack of interest in this component or an inability to locate the case study on the site may explain the lack of response. The case study, which is part of the Research Guide, does not appear until the fourth level of the site. Nor does it appear on the site map.

Comparisons to Other Art Museum Websites. The results of the comparisons indicate that the majority of participants thought that the Education Section, Usability, Information, and Use of Multimedia on the Bayou Bend website are at least as good as, if not better than, those components on other art museum websites. A better and more interesting approach might be to have the participants review two or more websites, without letting them know which one is being evaluated, and then ask them to compare specific features of the two sites.

The second research question this study addressed was "Are there statistically significant differences in perception by user group, user experience, user comfort level, or likelihood of a

revisit?" The results of the study indicate that there are statistically significant differences in user perceptions (a) by user group for content, educational value, and graphic design/page layout, (b) by user comfort level for graphic design/page layout, and (c) by likelihood of a revisit for content, educational value, information architecture, and graphic design/page layout. There are no statistically significant differences in user perceptions by user experience. The reasons for these differences are not immediately obvious, which suggests a need for further investigation regarding user perceptions.

User Group. Overall, the Bayou Bend Docents and the Others group rated all factors lower than the rest of the groups (i.e., Library Professionals, Faculty, Graduate Students, and K-12 Teachers). It is conceivable that the docents, many of whom know the collection extremely well, might be more critical than would other participants. In addition, the Bayou Bend website is representative of an organization with which the docents are very proud to be associated. It is reasonable to conclude that they took this evaluation very seriously in order to provide responses to help make the site better. It is not evident why both Bayou Bend Docents and Others rated the factors differently from the rest of the sample. The results seem to suggest that the Bayou Bend Docents and Others are more alike, and the Library Professionals, Faculty, Graduate Students, and K-12 Teachers are more alike. Perhaps Library Professionals, Faculty, Graduate Students, and K-12 Teachers may have more of an education background that makes them more similar.

Comfort Level. The participants who reported that they are "very comfortable" rated the Graphic Design/Page Layout significantly higher than those who reported that they are "not very comfortable" using the Internet. A review of all factor ratings shows that those who are "very comfortable" rated all factors higher than did those who are "not very comfortable." This

suggests that perhaps users who feel more comfortable using the Internet also perceive web pages more favorably than those who are not very comfortable using the Internet.

Likelihood of a Revisit. The participants who reported that they would be "very likely" to revisit the Bayou Bend website rated all of the factors higher than did those who reported that they would be "likely" or "not likely" to revisit. The participants who reported that they would be "likely" to revisit also rated all of the factors higher than did those who reported that they would be "not likely" to revisit. These results seem to indicate that the perceived quality and usefulness of a website may influence whether or not users will return to the site. For example, if users who want to use the site for educational purposes perceive the Educational Value as poor when they first visit, they are not likely to come back to the site.

Implications for Practice

This study suggests a number of implications for practice concerning the design, development, and evaluation of web-based educational resources. These include the need for (a) user involvement during each phase of development, (b) professional writers and copy editors, (c) routine site maintenance, and (d) improvement and further development of the educational and multimedia components, graphic design, and search system. In addition, there is a need to address the accessibility and usability of the site as well as to provide teacher training and technical support to both encourage and aid teachers in the use of the Bayou Bend website as an educational resource.

User Involvement. The results of this study seem to support the value of user involvement during each phase of website development as recommended by design and usability experts. The survey results demonstrate the useful feedback users can provide developers for making improvements to the design and content of the site as well as for guiding future

development efforts. Users, for instance, may be in a better position to identify problems and to make recommendations for future development than are developers. Bayou Bend docents, who rated the content slightly lower than any other group, commented on very specific concerns regarding the currency and accuracy of the content. In addition, the docents, who are the subject matter experts as well as potential users, were able to identify specific problems with the currency of the content of which developers were unaware (e.g., "Staff listing needs updating as of 2-11-01 with replacement of Nicole by Chad in the BB office"). Bayou Bend docents were also able to point out specific inaccuracies in the information (e.g., "There seems to be some conflict on the lesson plan site regarding the desk and bookcase. While it shows correctly that this is a Newport desk, later it talks about 'this Boston example'").

Content. Overall, the participants rated the content favorably in spite of the many errors pointed out by the docents in the comment section. Participant comments regarding the timeliness and accuracy of the information support Holzschlag's (1998) recommendation to hire a professional copy editor to ensure clean copy and a professional writer to ensure the quality of the writing. Not only should the information be accurate and interesting, it should be written specifically for the Web (Kilian, 1999). This means that information currently on the site taken from print sources, including the catalog and brochures, probably should be rewritten for use on the website in order to improve readability. Criteria for evaluating the quality of websites include the authority and reputation of the author or sponsor (Alexander & Tate, 1999; Cooke, 1999). Users, who rely on the reputation of the organization, in this instance the Museum of Fine Arts, Houston, to provide reliable information, will most likely assume that information that is provided on their website is correct. This suggests that an organization's website should adhere to the same high editorial standards as any of their publications. As suggested by the docent who

wrote, "I want this presentation to best represent the collection that I love," a website is indeed representative of the organization that sponsors it. Participants also commented on the type of information they would like to see added to the site (e.g., more lesson plans and activities and more information about Miss Hogg and the gardens).

Educational Value. The Educational Value factor received a low rating, suggesting a need for improvement for this aspect of the site. Participants made several good recommendations for improvements to the Education Section. One participant suggested, "More information on the Costume Presentation in the Education Section." This is an excellent recommendation since the same teachers who bring their students for tours of Bayou Bend, hopefully, will use the educational resources provided on the site to both prepare for the visit as well as to follow up on the visit. The costume presentation is something the students see during their tour of Bayou Bend. Some participants suggested adding more lesson plans and activities. Others recommended better lesson plans that support specific curricula (e.g., "The lesson plans could be a little difficult for new teachers who were not sure of the curriculum requirements of their grade"). The implication is that developers should add additional lesson plans and activities and involve teachers who will be using the materials in the creation of these materials. Maddux (1996) believes that the educational value of most web-based educational resources is limited because web authors, even educators, seem to ignore the principles of learning. The results of this study suggest a need for developers of web-based educational resources to address pedagogical strategies and the principles of learning during development. For instance, developers should provide both the learning objectives and grade levels on the lesson plans.

Some participants did not feel qualified or inclined to respond to some of the education-related items. One participant wrote, "The mention of schools reminds me of a suggestion for

improvement to the survey. The question about the usefulness of lesson plans is difficult to rate for someone who is not a public school teacher." A lower response rate subsequently resulted in lower scores overall for Educational Value. While the written comments indicate some concern with quality and number of lesson plans, a review of individual scores shows that many of the participants who did respond to these items rated the items favorably. This suggests that perhaps many members of the sample do not constitute an appropriate audience for evaluating the Educational Value of the website. Developers need to identify an appropriate audience qualified to evaluate individual special components such as lesson plans and activities for children.

Graphic Design/Page Layout. Although participants favorably perceived the Graphic Design/Page Layout, they wrote in comments and suggestions for improvement that developers should carefully consider. Some participants recommended the addition of more and larger images and suggested that the smaller images, for instance in the History and Gardens Sections, should be clickable for enlarged pictures. Participants also commented that the picture of the house on the home page and the map of the gardens are too small for clear viewing. Developers should consider enlarging the picture of the house as well as other pictures on the site and creating a larger, more legible map of the gardens. In addition, developers should consider adding pictures where they will provide interest and add value to the information on the site.

Search System. The Search System was less than favorably perceived by the participants in this study. Although part of this is due to a low response rate for items measuring the Search System, the results of the study suggest a need to make improvements to this component of the Bayou Bend website. Both the ratings and the written comments indicate that participants were unable to locate what they were looking for using the search tool. This may be attributable to the fact that most items are not currently in the database. Additionally, it is now more apparent that

the search interface is confusing. A browse feature or index may improve search results as well as make it clearer to users what objects are available on the site. The survey results also suggest developers need to improve the search help.

Multimedia. The comments of participants suggest a need to improve the quality of the video clips (e.g., "The streaming video at the site was blurred and garbled"). Written comments also suggest that developers should continue to develop the virtual room tour by adding the rest of the rooms and including more hot spots in each room. Many of the participants who were able to access the components rated them favorably, indicating that the components add interest and enhance the content. This suggests that the choice of multimedia components is appropriate for the purpose and audience for this website. Experts recommend the use of multimedia only if it adds interest and/or enhances the content (Cooke, 1999; Lynch & Horton, 1999). Developers, however, need to be concerned about the inability of many of the participants to access the multimedia components and should explore this apparent weakness in the site.

Accessibility. The results of the study pertaining to the multimedia components suggest that designers and developers need to be more cognizant of accessibility issues and to develop more accessible websites. This is especially important during the development of web-based educational resources, including supplemental online course materials or for distance learning. Lynch and Horton (1999) remind developers to consider how the site will function for those who do not have the best equipment, the most current software, and speedy Internet connections. As recommended by Willmarth (1998), designers should identify the *target audience hardware* just as they identify the *target audience* and design accordingly for that level of machine. Participants in this study commented on slow download times suggesting that many of them do not have fast Internet connections or state-of-the-art equipment and software.

The literature also emphasizes the need to consider physically disabled users, particularly those who are blind or visually impaired and may rely on assistive technology devices such as speech output devices that read the text from the computer screen. This study did not specifically address accessibility, but the inability of many participants to access the audio and video clips and the virtual room tour emphasizes the need to address accessibility issues during all phases of web design. Web-based educational resources should be accessible to all users.

Usability. The results of this study support the recommendation of experts to conduct usability testing during development (Mayhew, 1999; Nielsen, 2000). Some participants commented on problems and frustrations with the navigation and search systems. Rating scales and written comments cannot adequately address these concerns. Usability testing in which developers ask users to perform tasks (e.g., download a plug-in or search for an object in the collection) can help developers identify and resolve potential problems. Developers can observe users, asking them to verbalize their thought processes as they navigate the site to find information, search for art objects or plants using the collection and garden search systems, or access the multimedia components. While the written comments on the survey are helpful, it is difficult to tell exactly what kind of problems users are having when they write comments such as "I couldn't download real player or audio. Don't know why it wouldn't download." Being able to observe and talk to users about these problems will help developers correct them.

Teacher Training and Technical Support. Quality web-based educational resources are not enough. If teachers are successfully going to integrate technology into the curriculum and their teaching activities, they need to receive the proper training and the necessary technical support to be able to so do. Many of the comments discussed above, although not identified specifically with K-12 teachers, suggest a general lack of technical expertise among potential

Bayou Bend website users. Teacher training and technical support, provided through hands-on workshops, can give teachers practice in using the website and provide ideas on how the site may be used, for instance, as a preparation for a first-time visit or follow-up visit.

Routine Site Maintenance. The development of a website is not a one-time project. Someone must take responsibility for maintaining the website in order for the site to remain a viable, credible resource. For art museum websites, in particular, which provide timely information about upcoming and current exhibits, special events, lectures, or a calendar, it is critical to update that information on a routine basis. A good website also requires a certain amount of ongoing development, such as the addition of new information, new features, or a fresh new graphic design, to encourage repeat visits to the site. New information and an occasional new look will assure users that someone is maintaining the site. This, in turn, adds to the interest and credibility of the site.

Implications for Further Research

The results of this study suggest a need for further research concerning a number of different issues pertaining to website evaluation. Studies on (a) website visitor characteristics, (b) user design preferences, (d) accessibility and usability, (e) effectiveness of educational materials, and (f) collaborative website development, for instance, may provide further insight into the design, development, and evaluation of quality web-based educational resources. Survey research is helpful as an initial investigation of many of these issues but, as demonstrated by the comments from the Bayou Bend evaluation, qualitative methods may prove very useful for identifying and dealing with specific concerns.

Visitor Studies. If developers are designing for the users, as they should, there is a need to explore the characteristics of website users. Who are these users? Why did they visit the

website? What parts of the website did they visit? Did they have a satisfactory experience? What did they like? What did they not like? In addition, what kind of computers are visitors using? What type of Internet connection do they have? An online survey placed directly on the website can help to gather information about visitors to the site. Studies using log analysis may help to answer questions of where users come from, what pages they visit, and how long they stay.

User Design Preferences. Little research exists for user preferences in graphic design, page layout, navigation, and search interfaces on web pages, yet these preferences may affect user perceptions. The Graphic Design/Page Layout on the Bayou Bend website was favorably perceived by most of the participants, however, some participants wrote in comments expressing their preferences for typeface, font size, image size, and background color. Comments about typefaces and font sizes suggest that developers should leave typefaces and font sizes in the control of users. Browsers allow users to choose their preferred typeface and font size in the preferences menu unless developers override user preferences in the HTML code or with cascading style sheets. This is also an accessibility issue if users cannot increase small font sizes for easy viewing. Surveys and experiments on user design preferences may help developers to make appropriate design choices for web-based educational resources.

Accessibility and Usability. A content analysis of web-based educational resources using the Bobby accessibility software has the potential to reveal the most prevalent accessibility problems and to identify potential remedies for the problems (CAST, 2000). This information would be useful to web developers as they attempt to design and develop accessible websites. Formal usability studies can help to determine accessibility and to identify potential problems and concerns with the navigation, collection and garden search systems, multimedia components, and site map. Survey research can initially investigate accessibility and usability issues (e.g., Are

users able to access and use the information on the website?). Follow-up questionnaires and interviews with users may provide information that will allow developers to address specific weaknesses and concerns. Qualitative methods will allow developers to observe how users navigate or search, for instance, and to describe verbally the processes and problems users encounter. Studies are needed to discover why users have problems accessing multimedia components (e.g., expertise, equipment, or Internet connection speed). As educational institutions comply with recent legislation regarding accessibility (see Federal Information Technology Accessibility Initiative, 2001; Rehabilitation Act Amendments of 1998), studies to examine procedures and policies for compliance may prove beneficial to administrators and developers of educational websites.

Effectiveness of Educational Materials. Experimental studies using pre-tests and post-tests may gauge the effectiveness of lesson plans and other educational materials and activities based on art objects from the Bayou Bend Collection to teach the curriculum. Experimental studies using control groups may test the effectiveness of the virtual room tour on the website versus an actual Bayou Bend tour. This information could be useful for art, history, and social studies teachers who are unable to bring their students to Bayou Bend.

Collaborative Website Development. Finally, ethnographic or case studies on the collaborative development of educational websites may provide insight into the processes and challenges encountered during such projects that will help developers to have more successful collaborative experiences and to develop better websites.

Limitations of the Study

The final sample consisted of an extremely diverse population of potential Bayou Bend website users, which included very small groups of Bayou Bend docents, K-12 teachers, faculty,

graduate students, librarians and a group of other participants who responded to the survey because of their interest in web-based educational resources. The participants were not *actual users* of the Bayou Bend website, but rather volunteers solicited for the study because they are members of the targeted educational audience for the site, which makes them different from others who may use the Bayou Bend website.

Over 1,000 Bayou Bend docents, K-12 teachers, faculty, and students received invitations to participate in the evaluation by mail or in person during a presentation about the study. Thousands more were invited to participate through a number of online discussion groups on the topics of art, social studies, history, educational technology, and librarianship, but only a very small number responded to the request for participation. The low response rate and the mixed sample limit the generalizability of this study. In spite of these limitations, evaluative studies such as this can provide useful information for the development of quality web-based educational resources.

References

Alexander, J. E., & Tate, M. A. (1999). *Web wisdom: How to evaluate and create information quality on the Web.* Mahwah, NJ: Erlbaum.

Andres, C. (1999). *Great Web architecture.* Foster City, CA: IDG Books Worldwide.

Berson, M. J. (1996). Effectiveness of computer technology in the social studies: A review of the literature. *Journal of Research on Computing in Education, 28,* 486-499. Retrieved May 14, 2001, from WilsonWeb database (Education Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

Blumenstyk, G. (1998, July 17). Museums collaborate to place thousands of their art treasures on line. *The Chronicle of Higher Education,* pp. A29-A30.

Bowen, J. (2000). The virtual museum. *Museum International, 52*(1), 4-7.

Boyer, C. (1999). Using museum resources in the K-12 social studies curriculum. *Teacher Librarian, 26*(4), 26-27. Retrieved May 14, 2001, from WilsonWeb database (Education Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

Braun, J. A., & Risinger, C. F. (Eds.) (1999). *Surfing social studies: The Internet book.* Washington, DC: National Council for the Social Studies.

Braun, J. A., Jr. (1999). Ten ways to integrate technology into middle school social studies. *The Clearing House, 72,* 345-351. Retrieved May 14, 2001, from WilsonWeb database (Education Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

Barlow, J. G. (1998). Historical research and electronic evidence: Problems and promises. In D. A. Trinkle (Ed.), *Writing, teaching, and researching history in the electronic age: Historians and computers* (pp. 194-225). Armonk, NY: M. E. Sharpe.

Bridges, D. L., & DeVaull, F. L. (1999). Now that we have it, what do we do with it? Using the Web in the classroom. *Intervention in School and Clinic, 34,* 181-187. Retrieved May 18, 2001, from WilsonWeb database (Education Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

Cashen, T. (1995). The Internet and art history: A tool or a toy? *Computers and the History of Art, 5.2,* 15-32.

Cassutto, G. (2000). Social studies and the World Wide Web. *International Journal of Social Education, 15,* 94-101.

CAST (Center for Applied Special Technology). (2000). *Welcome to Bobby 3.2.* Retrieved April 29, 2001, from the World Wide Web: http://www.cast.org/bobby/

Cohen, B. (1998). *Social studies resources on the Internet: A guide for teachers.* Portsmouth, NH: Heinemann.

Cooke, A. (1999). *A guide to finding quality information on the Internet: Selection and evaluation strategies.* London: Library Association Publishing.

Crane, B. E. (2000). *Teaching with the Internet: Strategies and models for K-12 curriculum.* New York: Neal-Schuman.

Díaz, K. R. (Ed.). (1997). *Reference sources on the Internet: Off the shelf and onto the Web.* New York: Haworth, Press.

Diem, R. A. (2000). Can it make a difference? Technology and the social studies. *Theory and Research in Social Education, 28,* 493-501.

DiNucci, D., Giudice, M., & Stiles, L. (1997). *Elements of Web design.* Berkeley, CA: Peachpit Press.

Doyle, C., & Martorana, J. (1999). Evaluation workout: Exercises and techniques to teach critical thinking about Web resources. In S. Vincent & S. K. Norman (Eds.), *"All that glitters": Prospecting for information in the changing library world* (pp. 35-52). Stamford, CT: JAI Press.

Duff, J. N., & Mohler, J. L. (1996). *Laura Lemay's Web workshop: Graphics & Web page design.* Indianapolis, IN: Sams.net.

Fawkner, L. B. (1997). One museum discovers the Web. *Journal of Museum Education. 22*(1), 12-14.

Federal Information Technology Accessibility Initiative. (2001). Retrieved May 30, 2001, from the World Wide Web: http://section508.gov/

Fredericks, A. D. (2000). *Social studies discoveries on the net: An integrated approach.* Englewood, CO: Libraries Unlimited.

Fulford, R. (1996, Fall). Curators in cyberspace. *Canadian Art, 13,* 80-84.

Garrett, A. W. (1997). Computers, curriculum, and classrooms: Panacea or patent medicine? *Journal of Curriculum and Supervision, 13,* 114-118. Retrieved May 20, 2001, from WilsonWeb database (Education Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

Gray, D. E. (1999). The Internet in lifelong learning: Liberation or alienation? *International Journal of Lifelong Education, 18,* 119-126.

Head, A. J. (1999). *Design wise: A guide for evaluating the interface design of information resources.* Medford, NJ: CyberAge Books.

Holzschlag, M. E. (1998). *Web by design: The complete guide.* San Francisco: Sybex.

Johnson, R. (1998). Historical research on-line: A new ball game. In D. A. Trinkle (Ed.), *Writing, teaching, and researching history in the electronic age: Historians and computers* (pp. 183-193). Armonk, NY: M. E. Sharpe.

Kilian, C. (1999). *Writing for the Web.* Bellingham, WA: Self-Counsel Press.

Krug, S. (2000). *Don't make me think! A common sense approach to Web usability.* Indianapolis: Que.

Leu, D. J., & Leu, D. D. (with Leu, K. R.). (1999). *Teaching with the Internet: Lessons from the classroom.* Norwood, MA: Christopher-Gordon.

Londoño, E. (2000). Virtual Eldorado: The Museo del Oro on the Internet. *Museum International, 52*(1), 14-16.

Lynch, P. J., & Horton, S. (1999). *Web style guide: Basic design principles for creating Websites.* New Haven, CT: Yale University Press.

Maddux, C. D. (1996). The state of the art in Web-based learning. *Computers in the Schools, 12*(4), 63-71.

Mayhew, D. J. (1999). *The usability engineering lifecycle: A practitioner's handbook for user interface design.* San Francisco: Morgan Kaufmann.

Mioduser, D., Nachmias, R., Lahav, O., & Oren, A. (2000). Web-based learning environments: Current pedagogical and technological state. *Journal of Research on Computing in Education, 33,* 55-76. Retrieved March 29, 2001, from WilsonWeb database (Education Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

NCSS (National Council for the Social Studies). (2001). *National standards for social studies teachers.* Retrieved March 16, 2002, from the World Wide Web: http://www.socialstudies.org/standards/teachers/home.shtml

Nielsen, J. (2000). *Designing Web usability: The practice of simplicity.* Indianapolis, IN: New Riders.

Owston, R. D. (1997). The World Wide Web: A technology to enhance teaching and learning? *Educational Researcher, 26*(2), 27-33.

Partin, R. L. (1998). *The Prentice Hall directory of online social studies resources.* Paramus, NJ: Prentice Hall.

Pratt, G. F., Flannery, P., & Perkins, C. L. D. (1996). Guidelines for Internet resource selection. *College & Research Libraries News, 57*(3), 134-135.

Rehabilitation Act Amendments of 1998, 29 U.S.C. § 701 *et seq.* Retrieved May 4, 2001, from the World Wide Web: http://www.access.gpo.gov/uscode/title29/chapter16_generalprovisions_.html

Robin, B., Jenkins, A., Howze, W., & O'Connor, K. (2001). *A museum-university partnership to develop web-based educational resources.* Paper presented at the 2001 Museums and the Web Conference, Seattle, WA. Retrieved April 10, 2001, from the World Wide Web: http://www.archimuse.com/mw2001/papers/robin/robin.html

Rosenfeld, L., & Morville, P. (1998). *Information architecture for the World Wide Web.* Sebastopol, CA: O'Reilly.

Singleton, L. R., & Giese, J. R. (1999). The Internet and information literacy: Taking the first step toward technology education in the social studies. *The Social Studies (Washington, D.C.), 90,* 148-151. Retrieved May 20, 2001, from WilsonWeb database (Education Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

Solomon, G. (1999). Virtual museums. *Technology & Learning, 20*(2), 66.

Spool, J. M. (1999). *Website usability: A designers' guide.* San Francisco: Morgan Kaufmann.

Taylor, J. H., & Ryan, J. (1995). Museums and galleries on the Internet. *Internet Research: Electronic Networking Applications and Policy, 5,* 80-88.

TEA (Texas Education Agency). (2001). *Texas essential knowledge and skills (TEKS).* Retrieved May 20, 2001, from the World Wide Web: http://www.tea.state.tx.us/teks/

Trinkle, D. A., & Merriman, S. A. (Eds.). (2000). *The history highway 2000: A guide to Internet resources* (2nd ed.). Armonk, NY: M.E. Sharpe.

VanFossen, P. J., & Shiveley, J. M. (2000). Using the Internet to create primary source teaching packets. *The Social Studies (Washington, D.C.), 91,* 244-252. Retrieved May 20, 2001, from WilsonWeb database (Education Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

Warren, D. B., Brown, M. K., Coleman, E. A., & Neff, E. B. (1998). *American decorative arts and paintings in the Bayou Bend Collection.* Houston: Museum of Fine Arts and Princeton University Press.

Web-based Education Commission. (2000). *The power of the Internet for learning: Moving from promise to practice: Report of the Web-based Education Commission.* Washington, DC: The Commission. Retrieved May 20, 2001, from the World Wide Web: http://www.ed.gov/offices/AC/WBEC/FinalReport/WBECReport.pdf

Willis, A. (Ed.). (1997). *Teaching social studies with the Internet: Internet lesson plans and classroom activities.* Lancaster, PA: Classroom Connect.

Windschitl, M. (1998). The WWW and classroom research: What path should we take? *Educational Researcher, 27*(1), 28-33.

Wong, J. (2000). Museums without walls. *Art Business News, 27*(9), 120-122. Retrieved February 24, 2001, from WilsonWeb database (Art Full Text) on the World Wide Web: http://wilsonweb2.hwwilson.com/

Zorich, D. M. (1997). Beyond bitslag: Integrating museum resources on the Internet. In K. Jones-Garmil (Ed.), *The wired museum: Emerging technology and changing paradigms*. Washington, DC: American Association of Museums.

Zukas, A. (2000). Active learning, world history, and the Internet: Creating knowledge in the classroom. *International Journal of Social Education, 15*, 62-79.

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Appendix

Bayou Bend
Evaluation Survey

Please rate these items in accordance with the following scale:

1 = Strongly disagree 2 = Disagree 3 = Agree 4 = Strongly agree

	1	2	3	4
1. The organization responsible for the site is an expert on this subject				
2. The information appears to be up-to-date				
3. Contact information is available				
4. The purpose of the site is apparent				
5. The information adequately covers the subject matter				
6. The information adheres to high editorial standards				
7. The information appears to be factual				
8. Copyright information is available				
9. The information is well organized				
10. It is easy to find information about the collection				
11. It is clear where each link will take you				
12. It is clear which section of the site you are in at all times				
13. The navigation system for browsing the site is consistent				
14. The "Collection Search" makes it clear that **only** the collection is being searched				
15. The "Search Help" provides clear examples of how the search system works				
16. I found what I was looking for using the search system				
17. All of the pages have a similar look				
18. The graphic design supports rather than competes with the display of information				
19. The page layout makes the site easy to use				
20. The color scheme is appropriate for the subject matter				
21. The same basic elements appear in the same location on all pages				
22. The typefaces used are appropriate for the subject matter				
23. The information is clearly presented on each page				
24. There is a good balance between text and images				
25. The lesson plans are suitable for teaching the subject matter				
26. The activities for children reinforce the educational experience of an actual visit to Bayou Bend				
27. The Bellet Parlor "case study" provides insight into the work of a curator				
28. The bibliography is helpful for learning more about the subject				
29. The links to other Web sites in the "Education" section support the subject matter				
30. The site supports independent learning				
31. The depth of the information is adequate for educational purposes				
32. I would use this site as an educational resource				

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33. Were you able to access the audio clips?

○ Yes

○ No

If yes, please rate the following. If no, please proceed to item 36

34 The audio clips add interest to the site ○ ○ ○ ○

35 The audio clips enhance the content of the site ○ ○ ○ ○

36. Were you able to access the video clips?

○ Yes

○ No

If yes, please rate the following. If no, please proceed to item 39

37 The video clips add interest to the site ○ ○ ○ ○

38 The video clips enhance the content of the site ○ ○ ○ ○

39. Were you able to access the virtual room tour?

○ Yes

○ No

If yes, please rate the following. If no, please proceed to item 43

40 The virtual room tour adds interest to the site ○ ○ ○ ○

41 The virtual room tour is a good preparation for an actual visit ○ ○ ○ ○

42 The virtual room tour will attract visitors to the "real" Bayou Bend Collection and Gardens ○ ○ ○ ○

Please rate these items in accordance with the following scale:

1 = Much worse 2 = Worse 3 = About the same 4 = Better 5 = Much better

	1	2	3	4	5
43 Compared to other art museum Web sites, the education section of this site is	○	○	○	○	○
44 Compared to other art museum Web sites, the usability of this site is	○	○	○	○	○
45 Compared to other art museum Web sites, the information available on this site is	○	○	○	○	○
46 Compared to other art museum Web sites, the use of multimedia on this site is	○	○	○	○	○

Please tell us about you.

47 Which of the following best describes your status? Please check all that apply

☐ Bayou Bend Docent

☐ K-12 Teacher

☐ College or University Faculty

☐ Undergraduate

☐ Graduate Student

☐ Other (Please describe in the box below.)

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48 Which of the following best describes your area of subject expertise? Please check all that apply

- ☐ Art Education
- ☐ Decorative Arts
- ☐ Fine Arts
- ☐ Social Studies Education
- ☐ U S History
- ☐ Other (Please describe in the box below)

49 Which of the following best describes how often you use the Internet?

- ○ Almost never
- ○ Monthly
- ○ Weekly
- ○ Daily

50 How comfortable are you with using the Internet?

- ○ Very uncomfortable
- ○ Not comfortable
- ○ Comfortable
- ○ Very comfortable

51 Approximately how much time did you spend looking at the Bayou Bend Web site in order to evaluate it?

- ○ Less than 15 minutes
- ○ 15 to 30 minutes
- ○ 30 minutes to an hour
- ○ More than an hour

52 How likely are you to visit the Bayou Bend Web site again?

- ○ Very unlikely
- ○ Not likely
- ○ Likely
- ○ Very likely

53 Comments or suggestions for improvement to the site

Submit Clear

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